

Project Title:

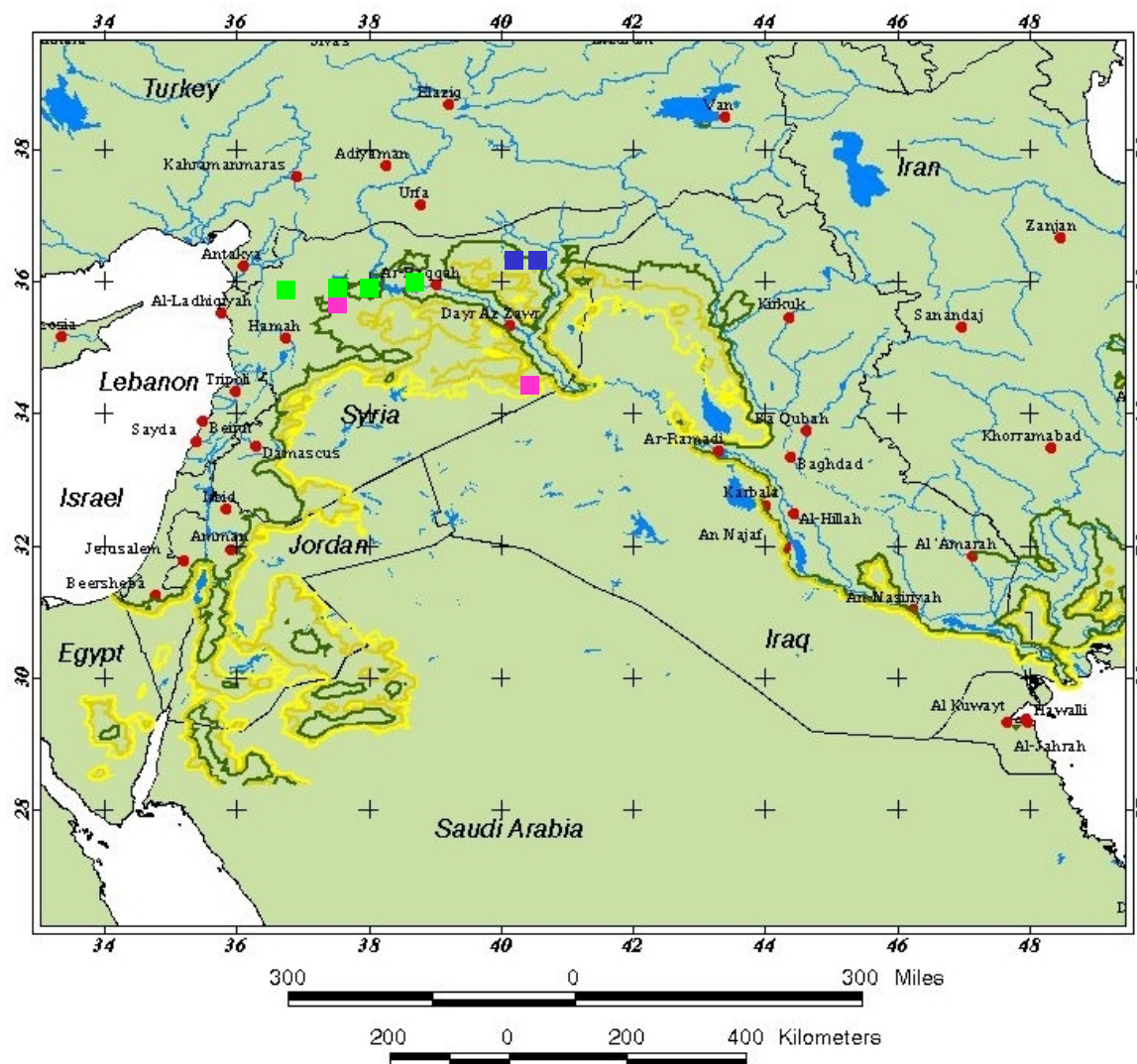
Changing Landscapes in the Middle East

Funded by:




NASA's Earth Science Enterprise

Keywords: Landscape monitoring, climate change, degradation of dry-lands, range management, irrigated agriculture, hydrology





Green periods calculated from
AVHRR 8km NDVI time series 1981-1999
Threshold value chosen: NDVI = 0.1

-  45 days green period
-  90 days
-  150 days

IKONOS Image Locations and
ongoing Studies

-  Farmland
-  Rangeland
-  Farmland/ Rangeland/
Archaeological

Objectives

Assessing Range Condition: (Degradation/Desertification)

Composition of Range Vegetation

Soil Erosion or its Depletion in certain Components

Causes of Degradation/Desertification:

Human Activities (Type, Distribution, Pressure)

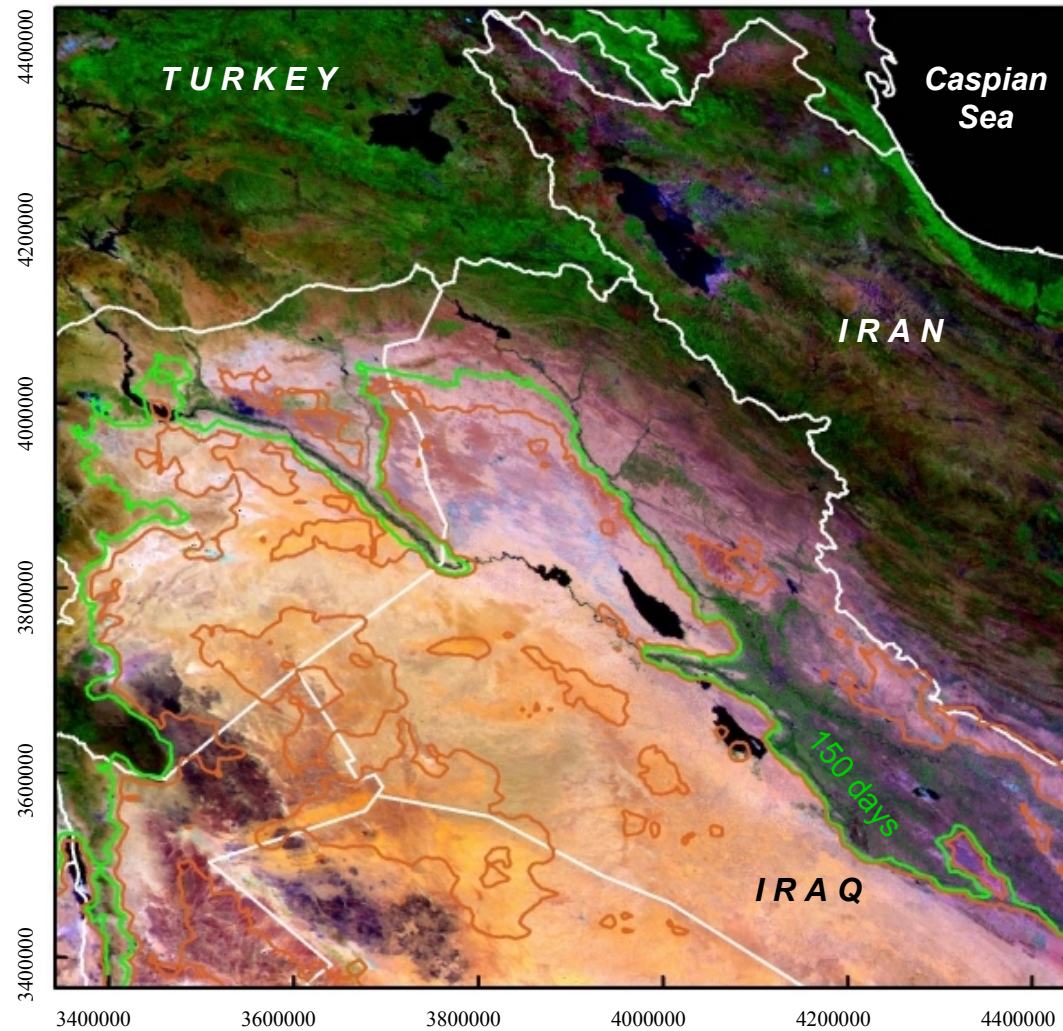
Other Influences (Climate, Physical, Social, Economic, Political, others)

Range Management:

Correlation of biophysical parameters and spectral field measurements to spectral signatures in satellite data of different spectral and spatial resolutions.

Biophysical parameters of interest are: Grazing limits/potential, Carryability and the way its triggered by climatic parameters.

Subproject “Rangeland”



MODIS Image

Compositing Period: 09/06 – 15/06/2000

Scene Location: h25, v05

Bands: 7,2,3 > RGB

Projection: Sinusoidal

Steppe Vegetation

Perennial Shrubs:

Feed Stuff	palatable shrubs
Fire Wood	palatable and unpalatable (invader)
Soil Fixation/Stabilization (Wind and Water)	palatable and unpalatable (invader)
Preferred Growing Sites for Annuals	palatable and unpalatable (invader)
Carbon Sequestration over the entire year	palatable and unpalatable (invader)

Annual Grasses:

Feed Stuff
Soil Fixation (Water Runoff)

Seasonal Spectral Changes in a Degraded Area



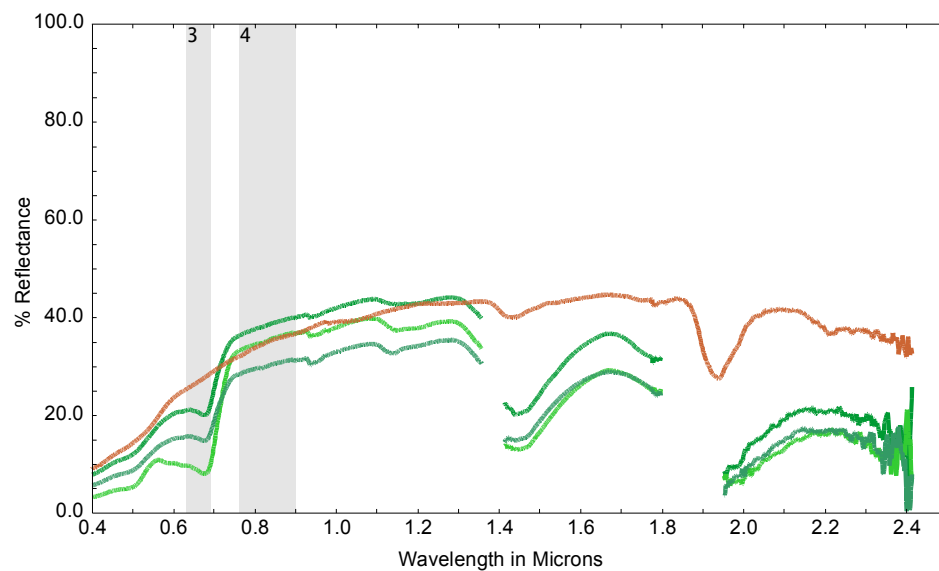
Landsat TM 5 bands / IKONOS bands 3 and 4

— Silty soil

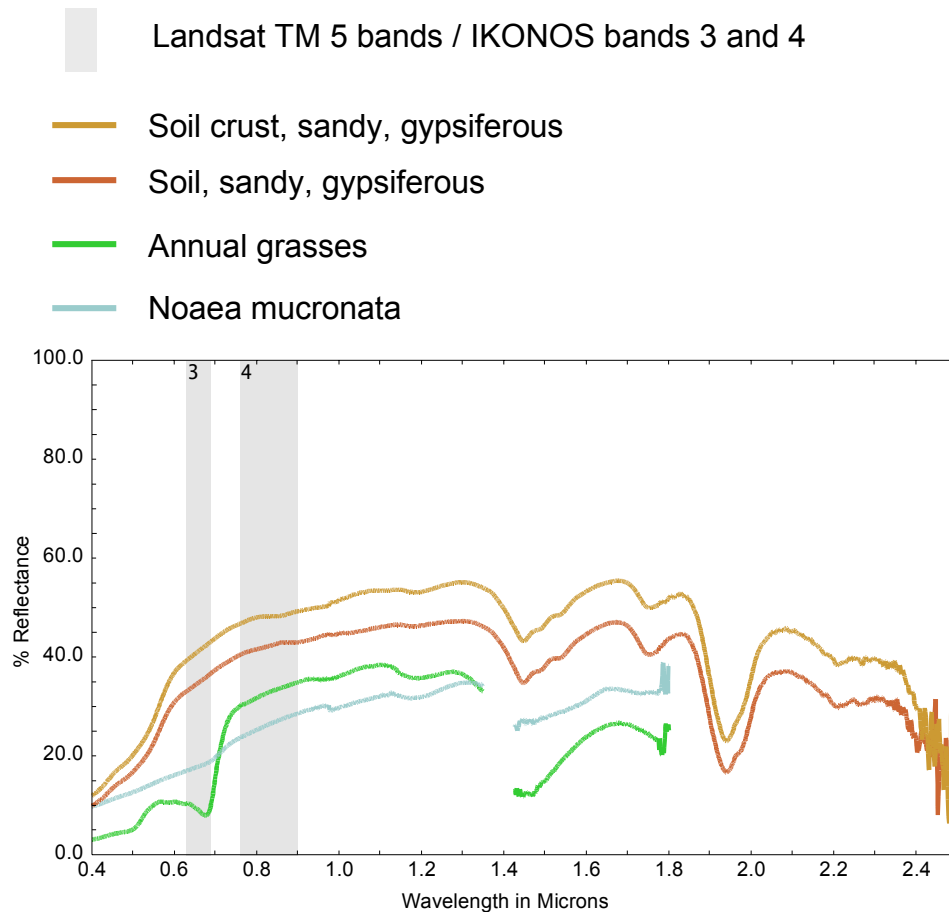
— Annual Grasses, low density

— Annual Grasses, medium density

— Annual Grasses, high density



Spectra of Annuals, Perennials and Soils



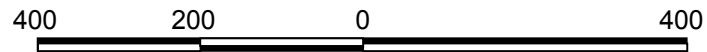
25/02/01

Change Vector Analyses

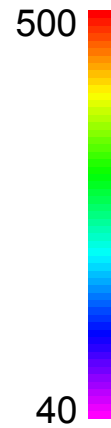
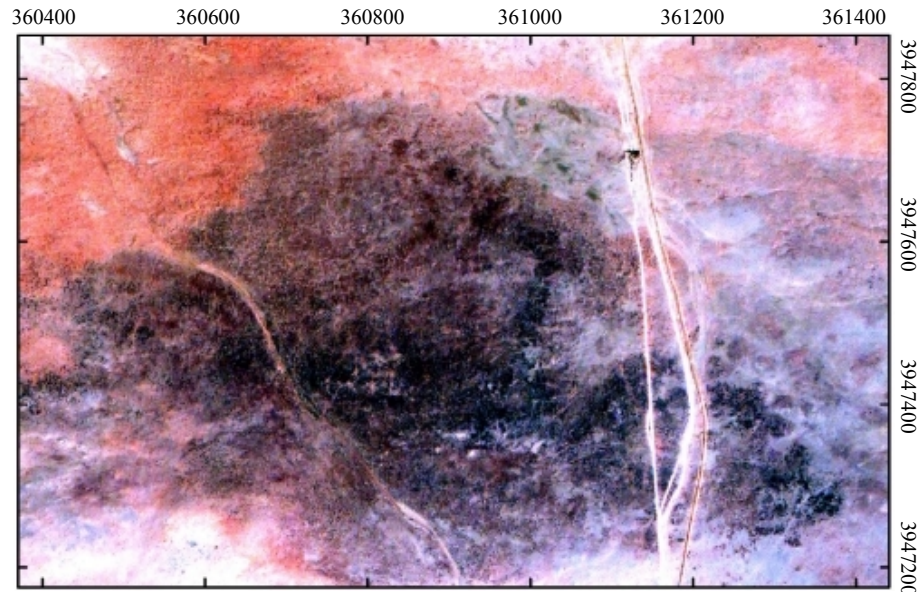
From IKONOS subsets, 4 bands:

27th Mar 2000

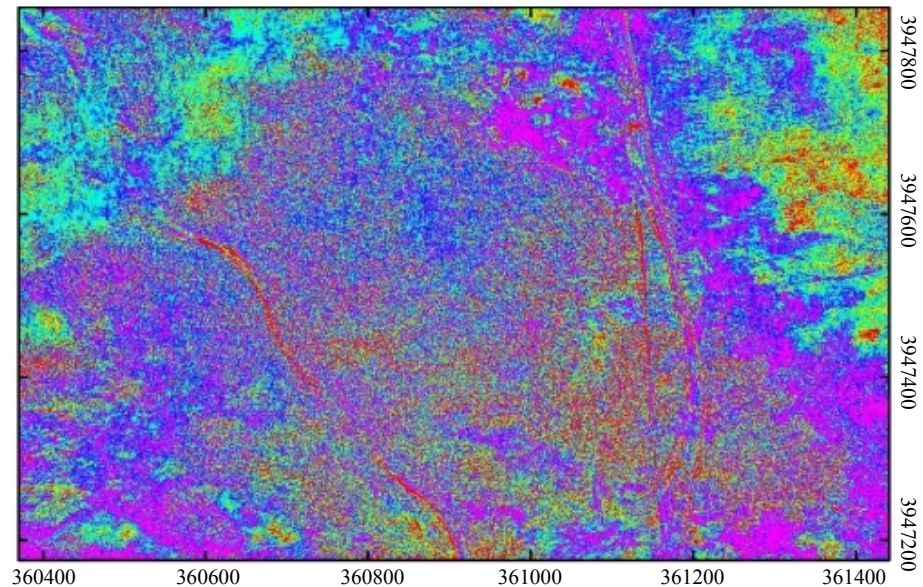
05th Oct 2000



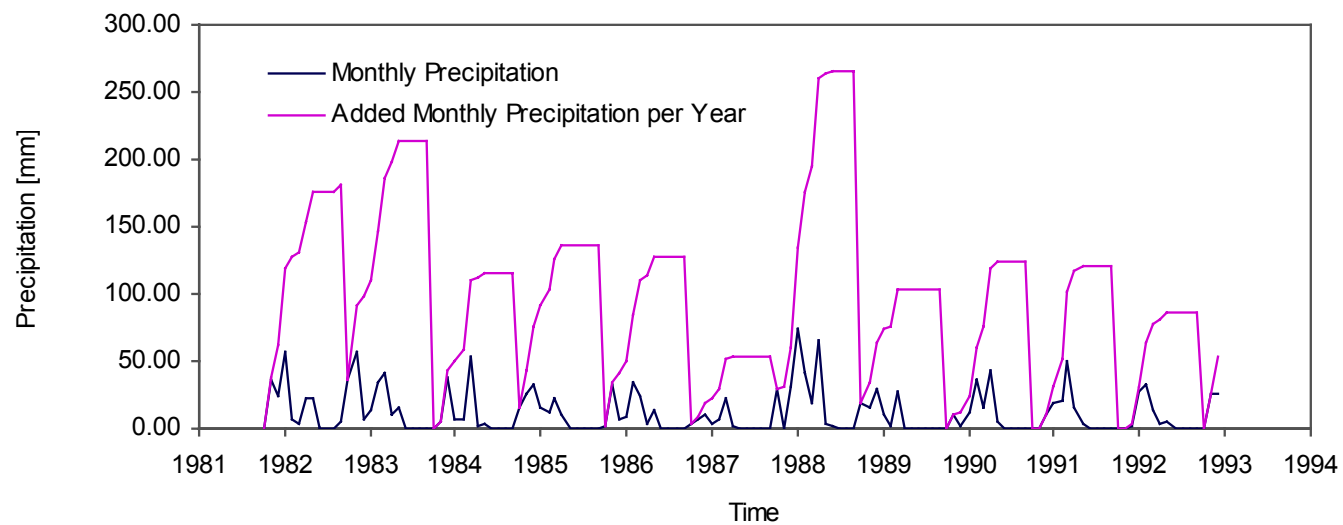
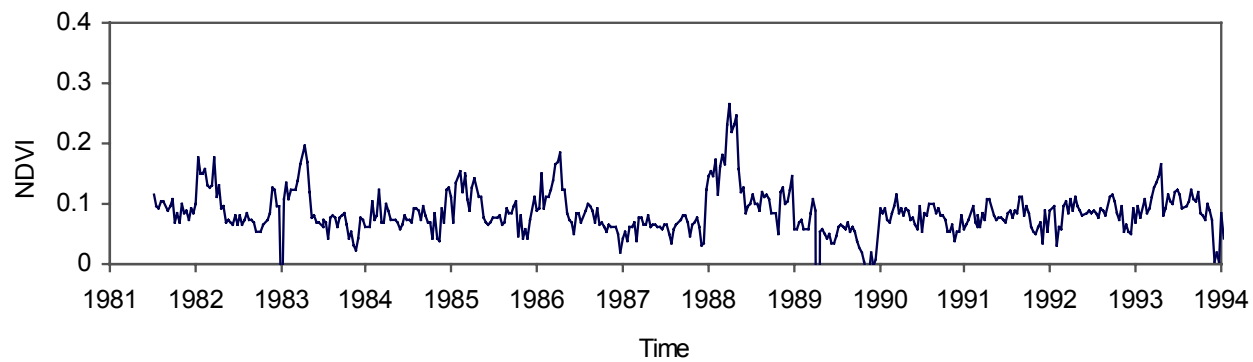
Color Composite: 4,3,1 > RGB
27th Mar 2000



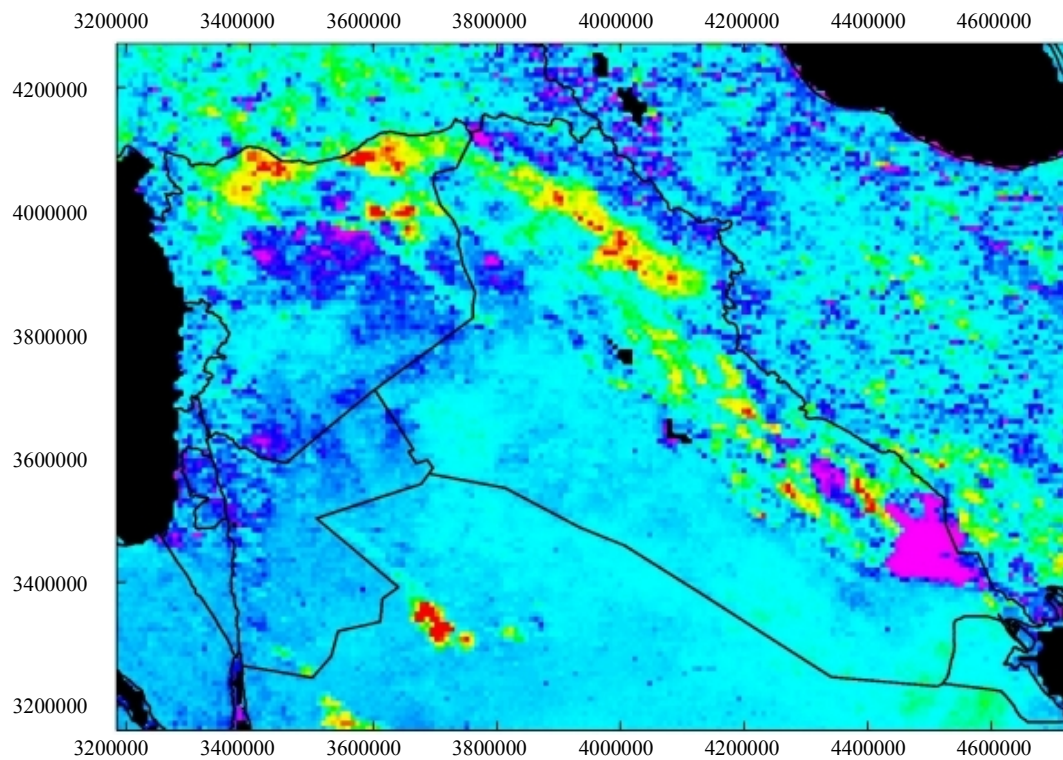
Change Magnitude



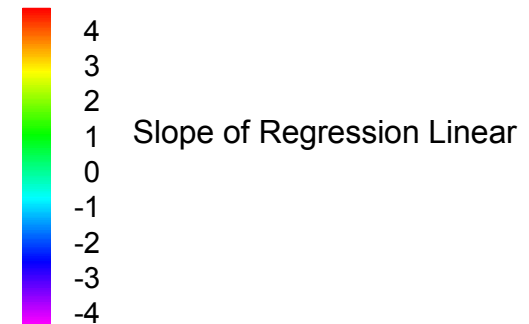
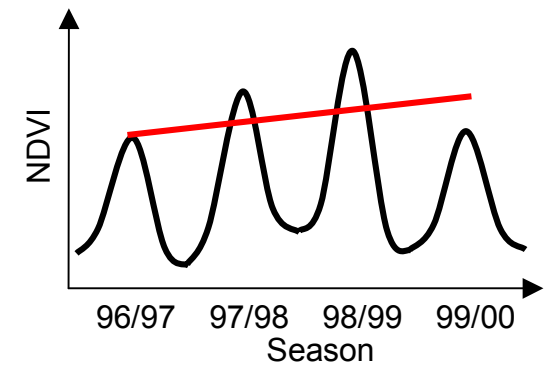
NDVI Cycles



Trend of $NDVI_{max}$ calculated from Seasons 81/82-98/99



Projection: Sinusoidal



Composite Signature of Shrub Grown Areas

Triggered by:

Shrub Species

Shrub Density

Background Reflectance

Soil, Outcrops, Annual Grasses, Pebbles,
and Variations in these Components

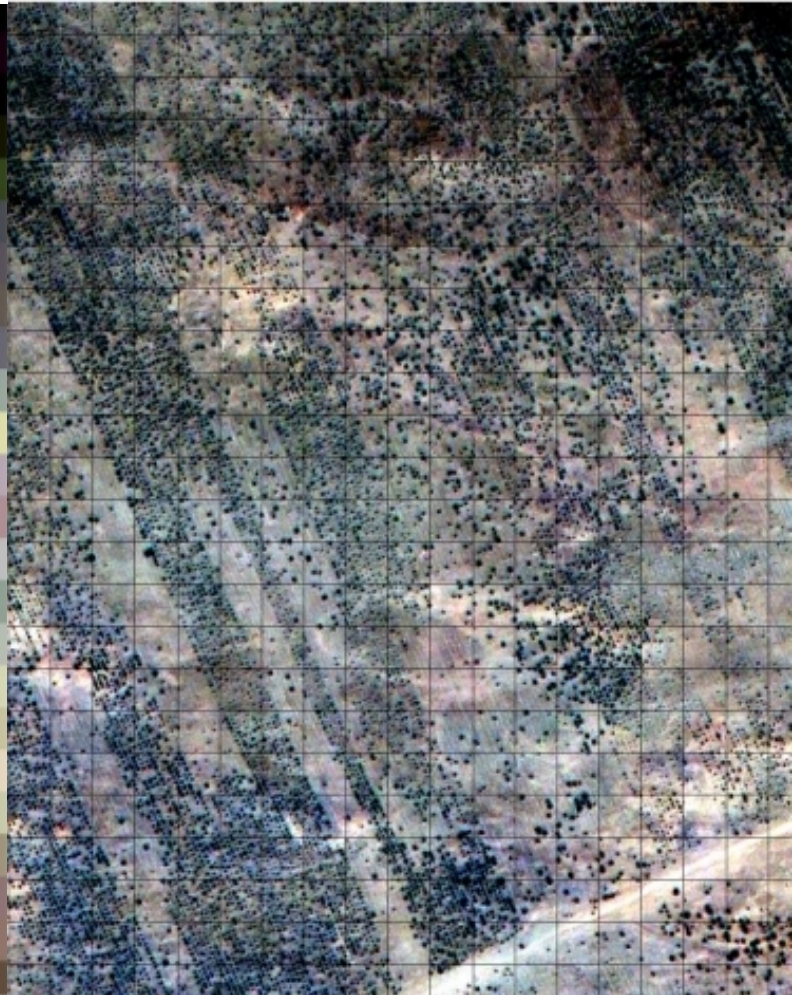
Seasonality

TM5, 30m



Acq. Date 01/05/98, Bands 4,3,1 > RGB

IKONOS pan-xs merge 1m



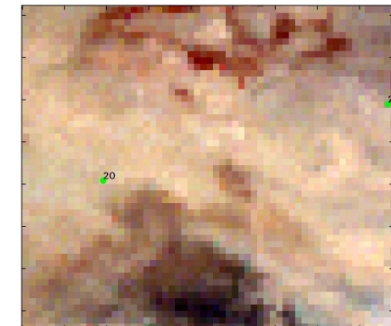
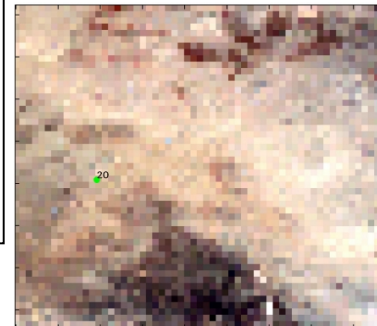
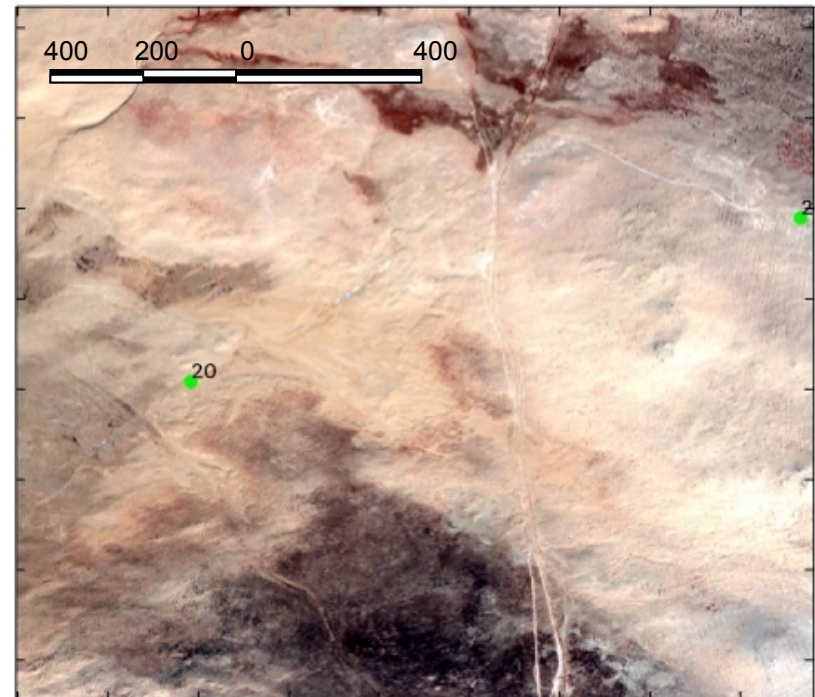
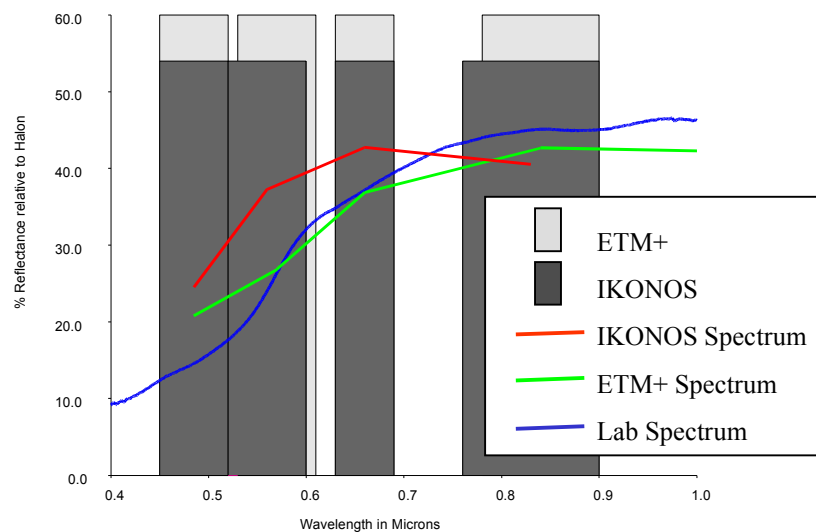
Acq. Date 27/03/00, Bands 4,3,1 > RGB

Spectral Signatures

IKONOS xs (Up): 4,2,1 > RGB
05th Oct 2000

IKONOS xs (LL): degraded 30x30m
4,2,1 > RGB

ETM+ (LR): 4,2,1 > RGB



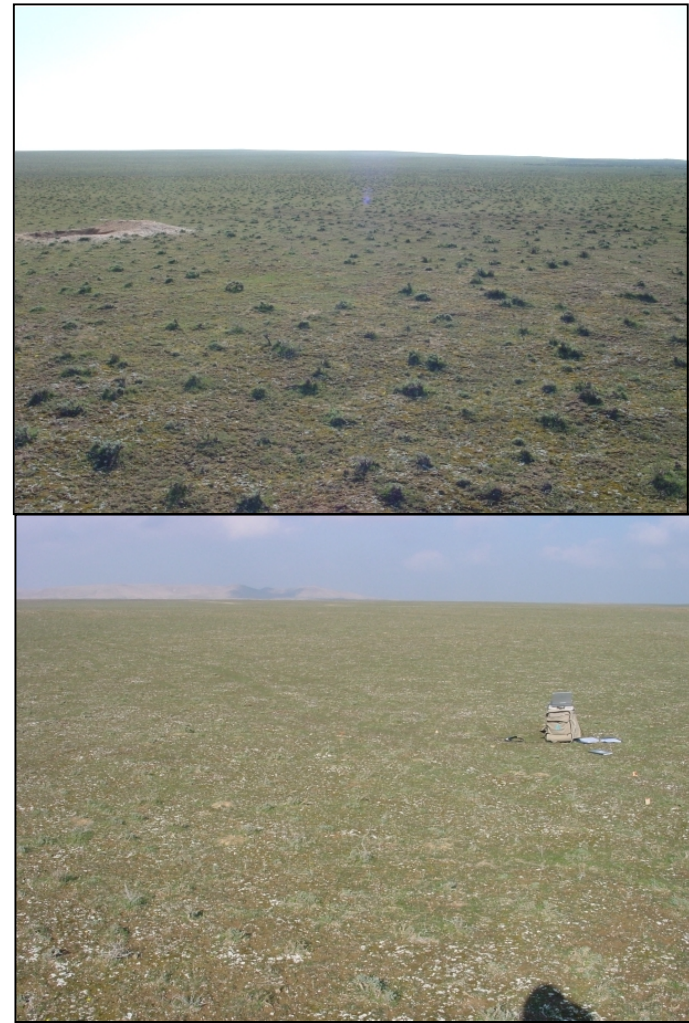
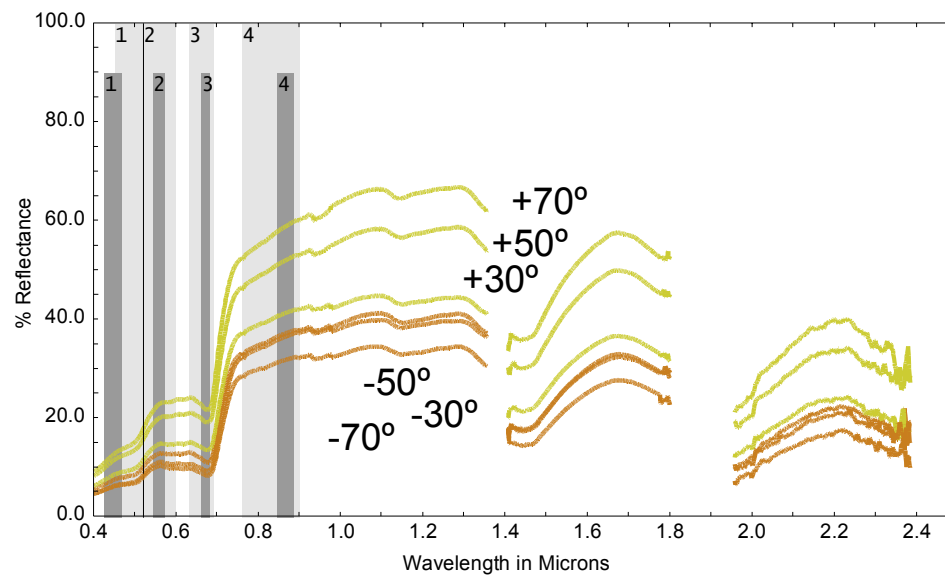
Angular spectral measurements

■ Landsat TM 5 bands / IKONOS bands 1 to 4

■ MISR bands

— Into sun

— Into shadow



Causes of Desertification/Degradation

Human Impact:

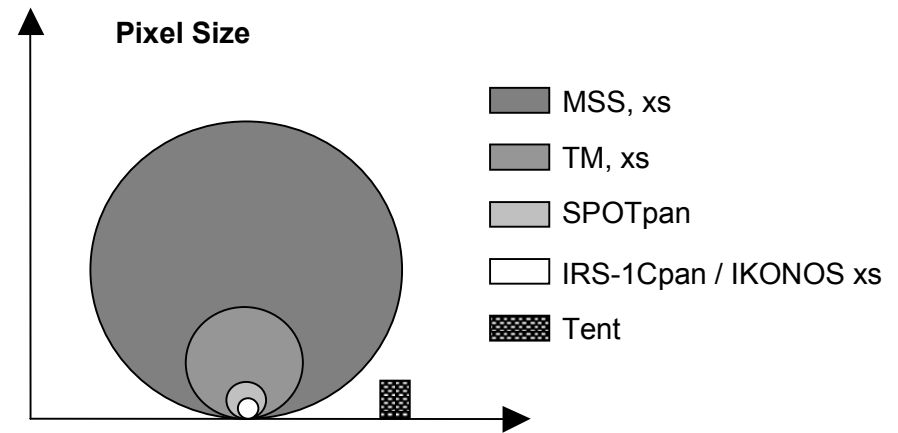
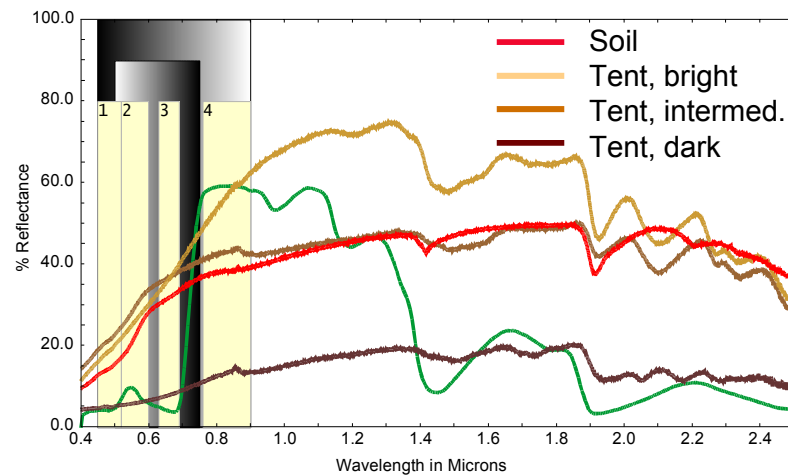
- Rainfed Agriculture
- Overgrazing
- Shrub Uprooting for Firewood
- Cross Country Driving

Climate:

- May Enhance or Mask Degradation Trends
- Initiated by the above Activities

To make responsible ministries and organisations act requires sufficient evidence about causes and effects of degradation.

Criteria for Tent Identification



IRS-1C pan

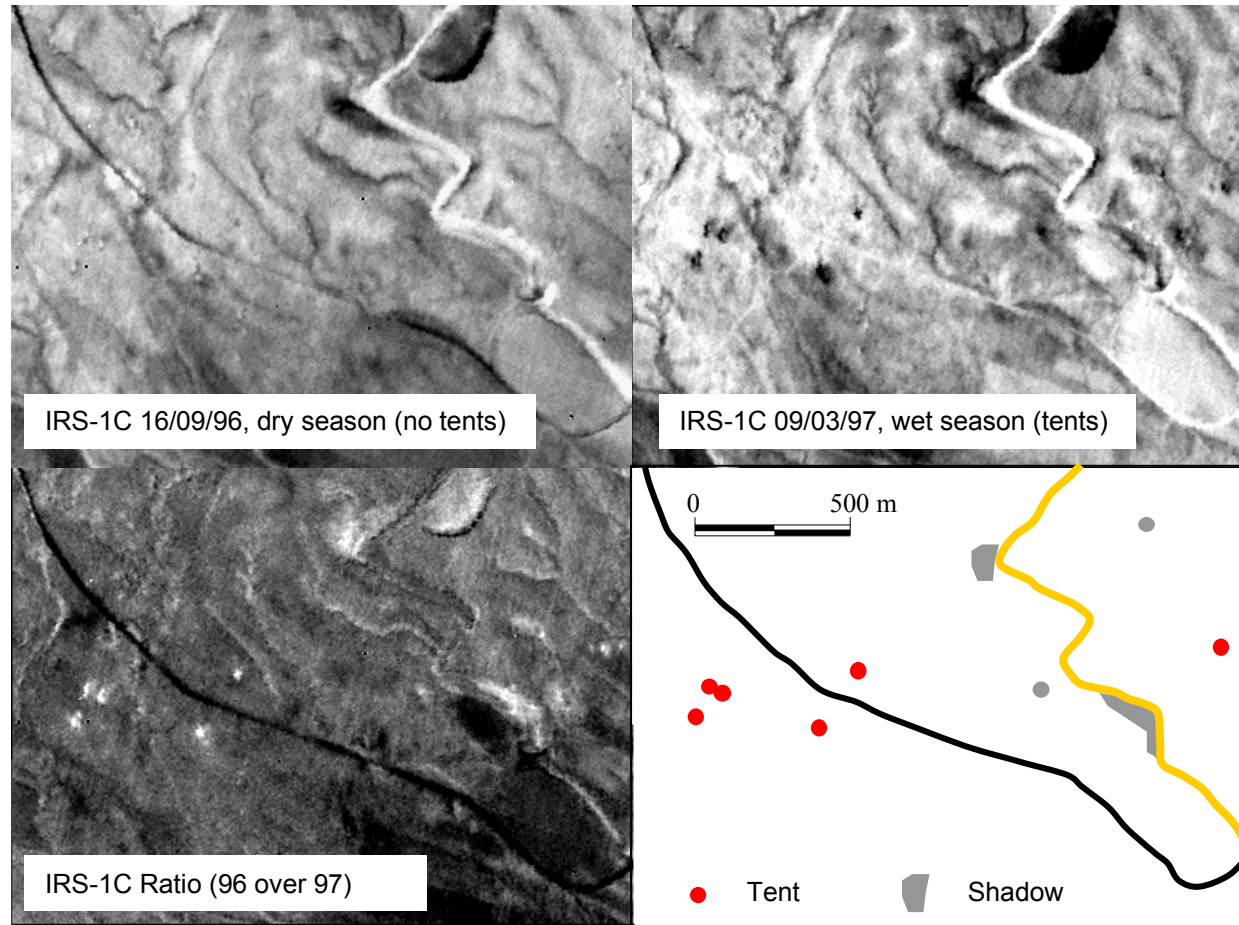


IKONOS pan

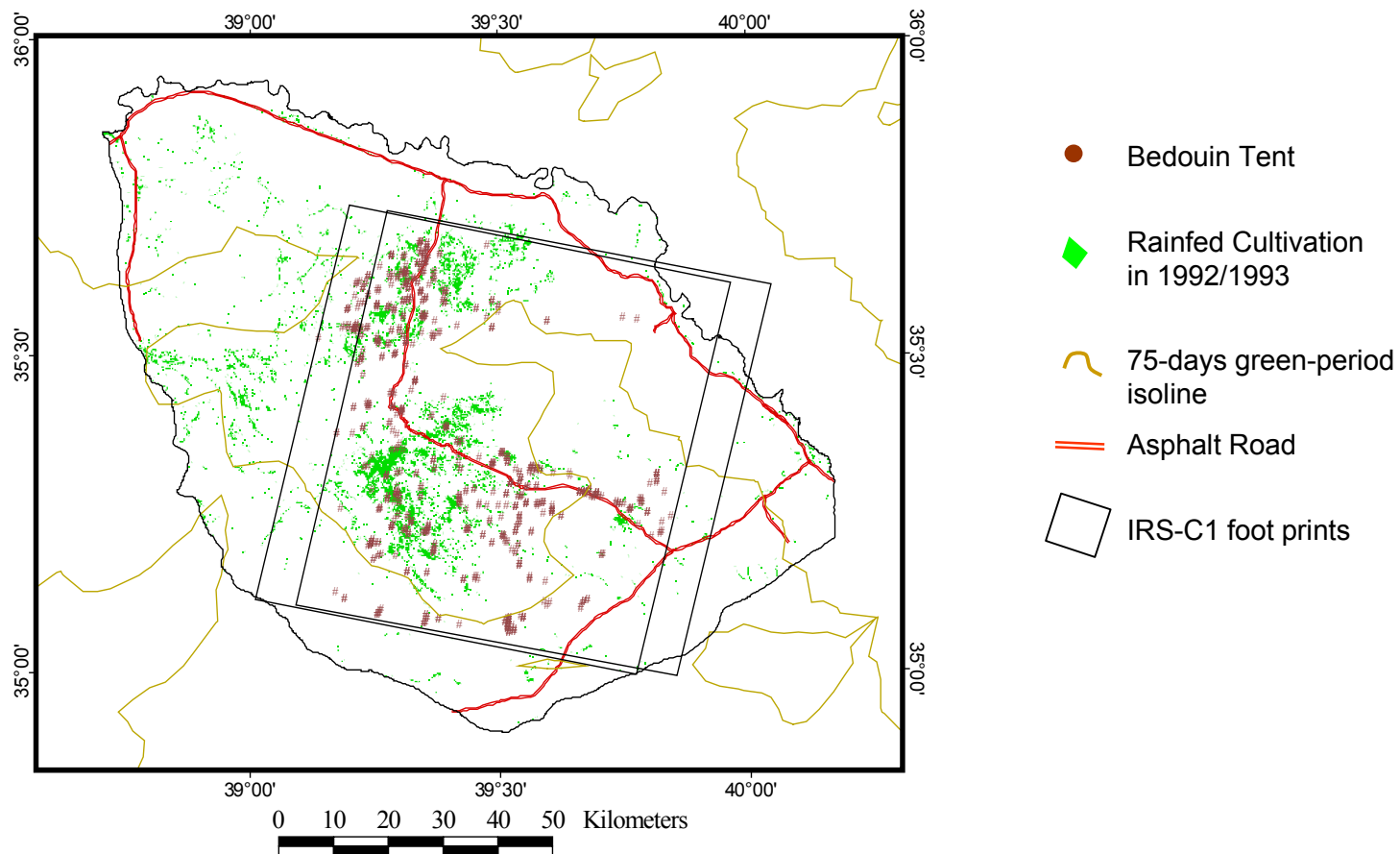


IKONOS xs

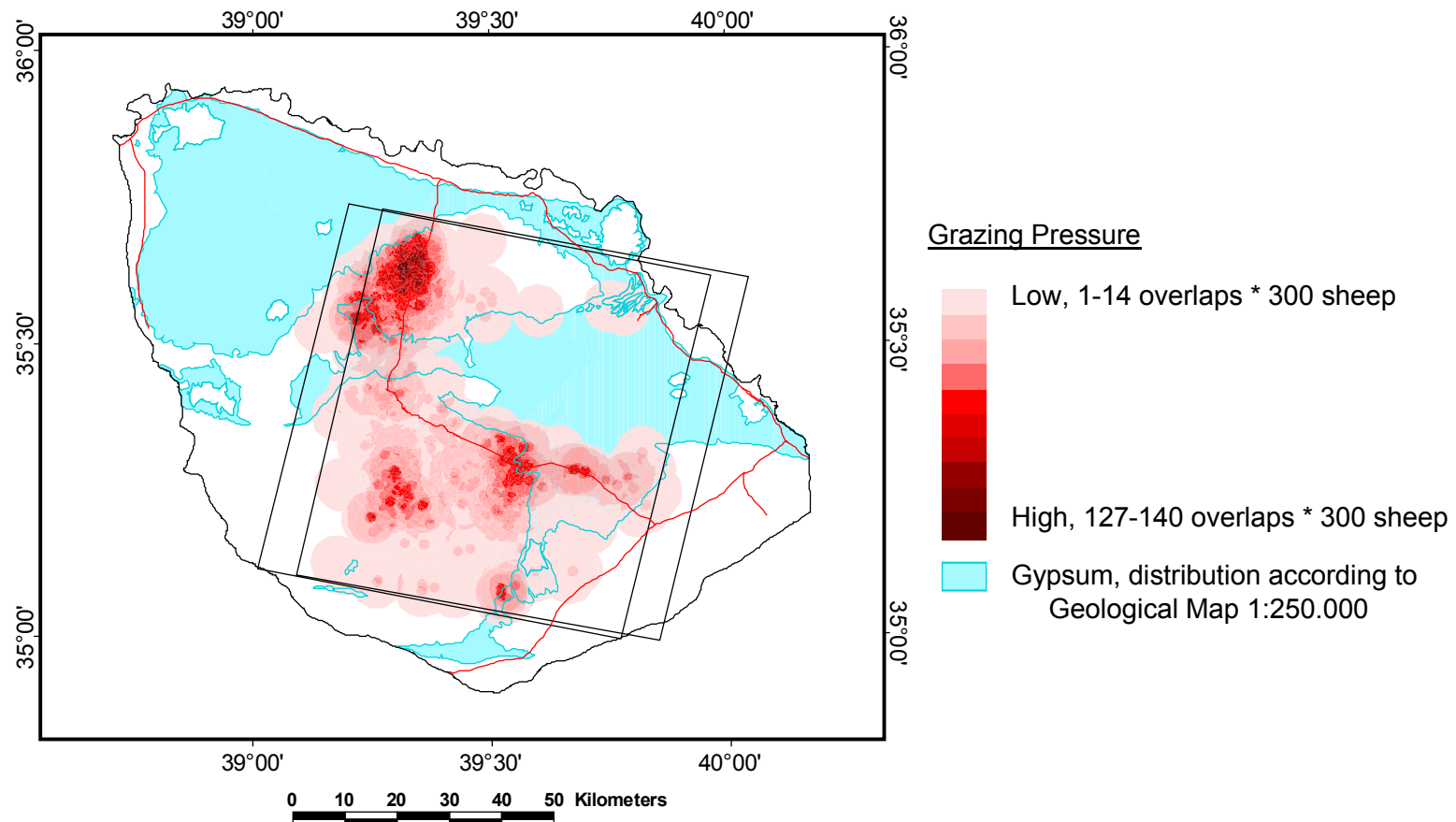
Tent Identification from *IRS-1C* pan



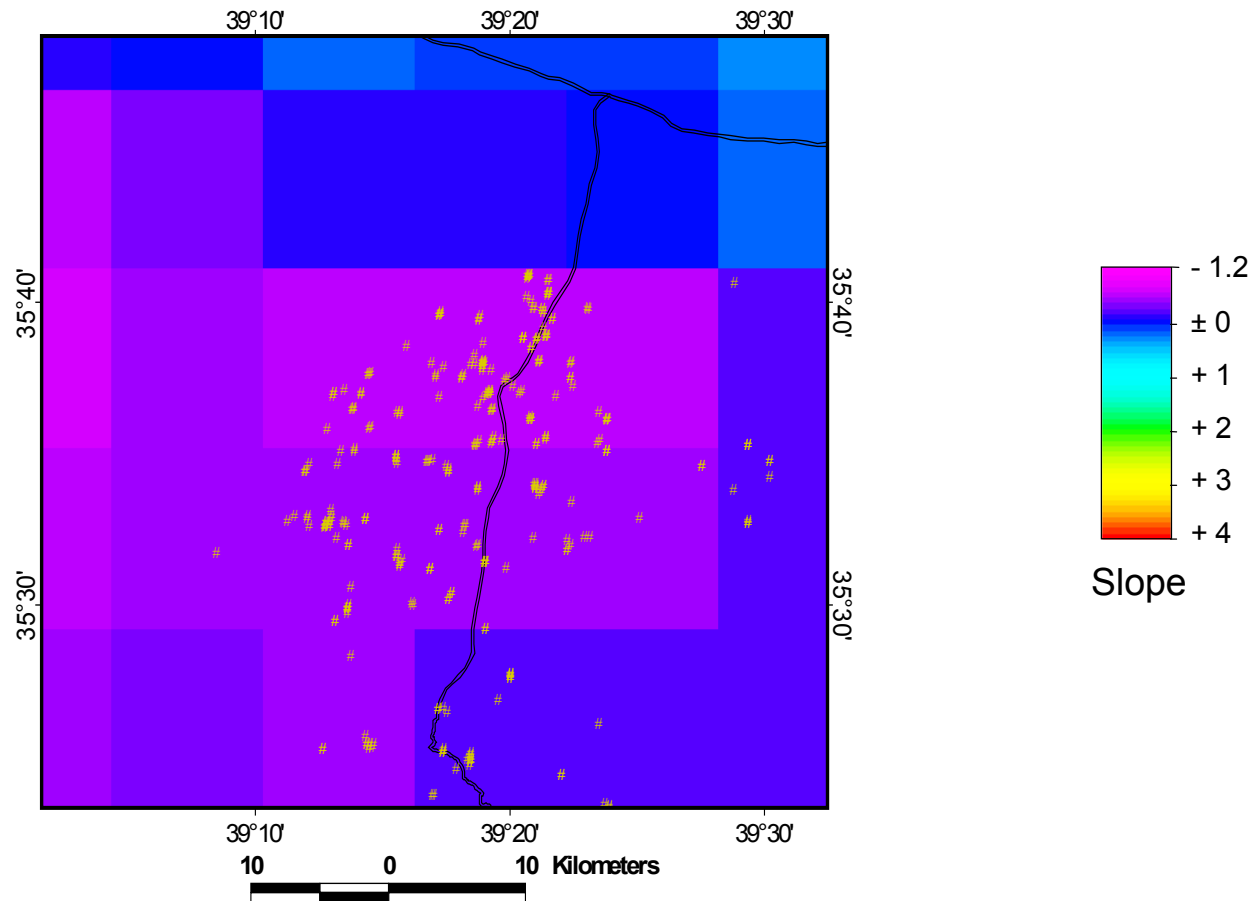
Tent Distribution



Grazing Pressure



Tent Distribution and Degradation

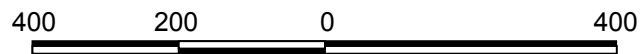


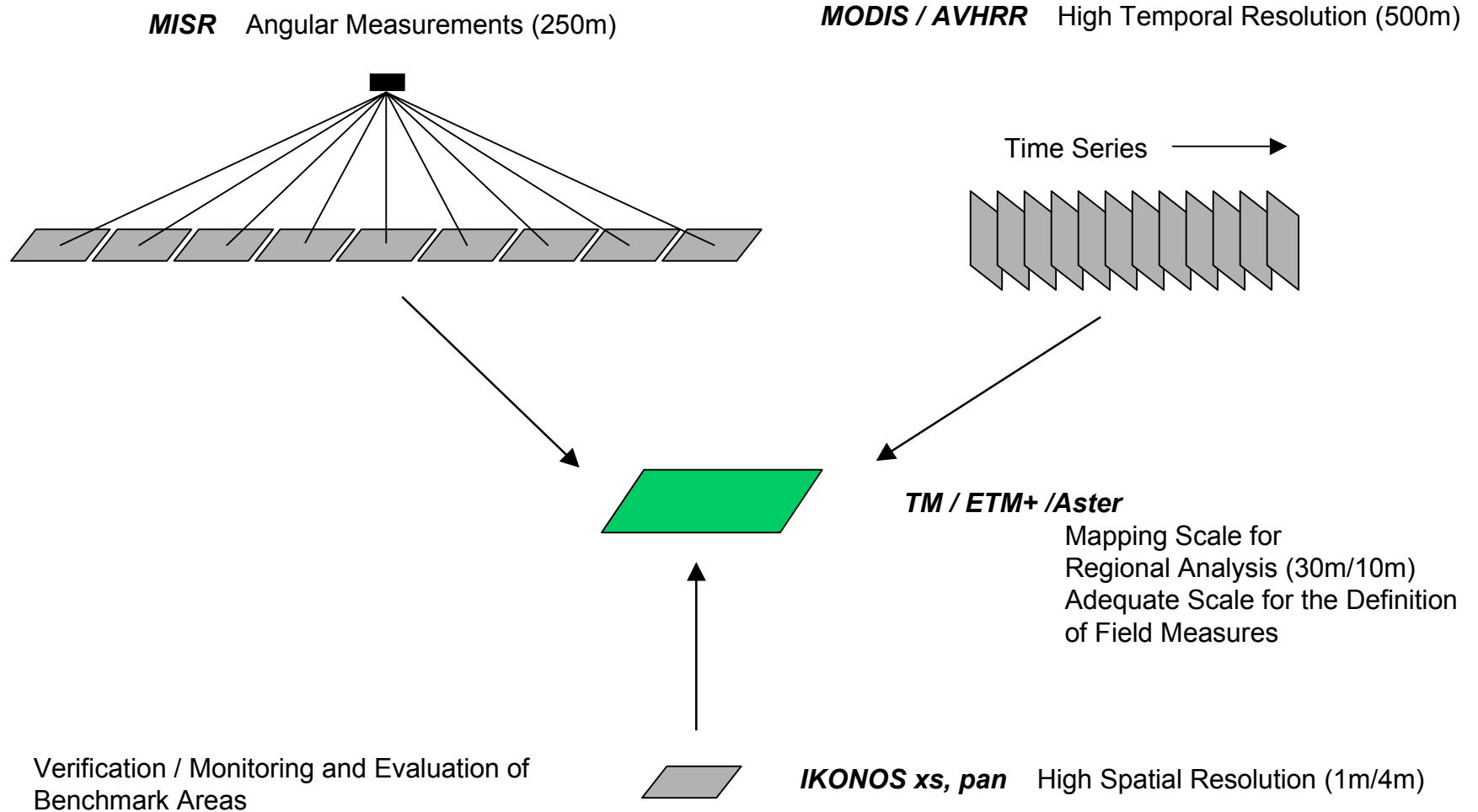
Bedouin Tents

IKONOS xs (4,3,1 > RGB)

IKONOS pan

IKONOS xs/pan merge





Studying IKONOS Images

Identification of spectral signatures of shrub grown areas for extrapolation using data of lower spatial resolution (TM / ETM+ / Aster).

Studying shrub densities and possibilities of extrapolation using MISR data.

Monitoring representative areas to study human impact on range lands

Upscaling and down scaling of spectral information between images of different resolution

Algorithms for texture identification

Results of “Range Land“ Subproject

Separating Fluctuations from Degradation

Improved description of range lands

Managing rangelands: Establishing proper
Stocking Rates and Grazing Periods

Forecast Models for adapted land use: Timing of grazing

Definition of rehabilitation areas and rehabilitation activities

Improved monitoring and evaluation of degradation / rehabilitation

Shrub Identification from TM

